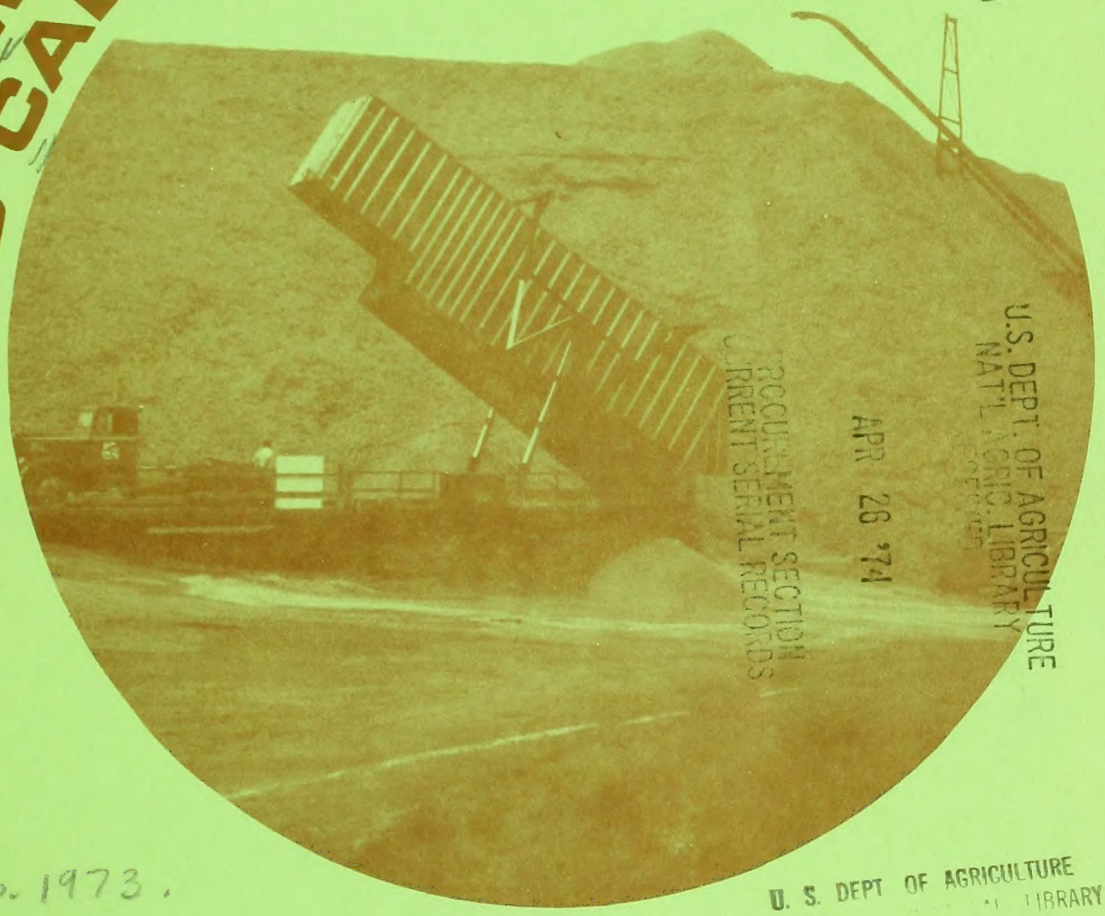
usda forest service research paper pnw-169

1973

FIBERWOOD USE IN WASHINGTON, OREGON, AND CALIFORNIA, 1970-80



JOHN W. AUSTIN

pacific northwest
forest and range experiment station
u.s. department of agriculture forest service
portland, oregon

ABSTRACT

This report is based on a survey of pulpmills, board mills, and felt mills in Washington, Oregon, and California in 1970 and 1971. Pulpmill capacity is expected to rise 10 percent over 1970 capacity by 1980; particle board capacity will rise by 80 percent; hardboard up 32 percent; and insulation board up 17 percent. Capacity expansion is limited by pollution control requirements and final product market.

Wood use in these mills is expected to increase 19 percent to 17.7 million ovendry tons per year by 1980. Mills expect future fiberwood consumption to follow closely the current pattern, consuming approximately 3 million tons of roundwood logs per year and obtaining the remaining 14.7 from sawmill and plywood residues. To do this, mills will use an increasing amount of bark, sawdust, and dry material from a wider range of species. There are no plans to utilize logging residue material except as this material is converted to utility grade material and removed at time of harvest.

Under assumptions of declining timber harvest and increasing log exports, the amount of timber available for lumber and plywood production will decline. This implies that the amount of fiberwood available from mill residues will also decline. Consequently, in order to insure fiberwood needs, pulp and board plants will have to consider alternative sources such as thinnings and logging residues. These plants will also soon be more competitive among themselves and with sawmills and plywood mills for existing log supplies.

KEYWORDS: Fiberwood, wood utilization.

CONTENTS

BACKGROUND AND OBJECTIVES

Present and future supplies of timber are limited. However, there are large volumes of logging and milling residues which cannot be sold at current prices. Lack of a market for these residues is causing problems for land managers and mill operators in Washington, Oregon, and California. Burning has been the traditional approach to disposing of these materials; however, this method is meeting increased opposition from those concerned with environmental quality. Increased consumption of residues by the pulp and board industries is one possible means to reduce residue volume.

The objective of this study is to evaluate the potential of these industries to increase residue consumption over the decade 1970-80 and to note likely changes expected in source and form of material consumed.

The following information is a basis for evaluating residue consumption potential. Mill capacity and limits to capacity expansion are discussed first because capacity is the base for all wood use. Product mix and its relation to form of material used is then examined for likely changes. Next, current and expected volumes of material consumed by form, source, and species are examined to bring out the roles expected to be played by roundwood, logging, and milling residues. Wastepaper use and its relation to sawdust use is defined, followed by an analysis of dependency on purchased chips between pulpmills and board mills. Finally, current raw material specifications and expected changes in these specifications are discussed to give some insight on how wood use in the pulp and board industry will change over the 1970-80 period.

STUDY PROCEDURE AND LIMITATIONS

PROCEDURE

Data were collected by questionnaire and interview with every wood-using pulp-, board-, and felt-mill operation in Washington, Oregon,and California. The base year for data collection was 1970. We collected information for 1980 by asking each respondent what he expected for his firm. We used this approach, knowing that capacity expansion in the pulp and board industries usually requires 4 to 5 years of planning and believing that industry representatives have a good feeling for the future outlook of their operations. One drawback of this approach is that we do not know how well each firm compensates for the expansion of competing firms.

In order to avoid data disclosure for individual mills, present and potential industry capacity and fiberwood use were analyzed in terms of the eight geographic regions shown in figure 1. Data on the current characteristics of the industry are meant to complement other mill surveys (*1*, *2*, *3*, *4*, *7*).

ECONOMIC SETTING AND LIMITATIONS

Interviewees may have been influenced by the economic setting at the time of the interview. Data for this study were collected from the summer of 1971 to the summer of 1972. The paper industry's performance, as measured by the return on invested capital, was only 5 percent in 1970 and decreased to about 3 percent in 1971. This low return on investment has been attributed to higher costs for pollution control; adverse effects of dock strikes on export business; closure of obsolete facilities; and high interest charges on

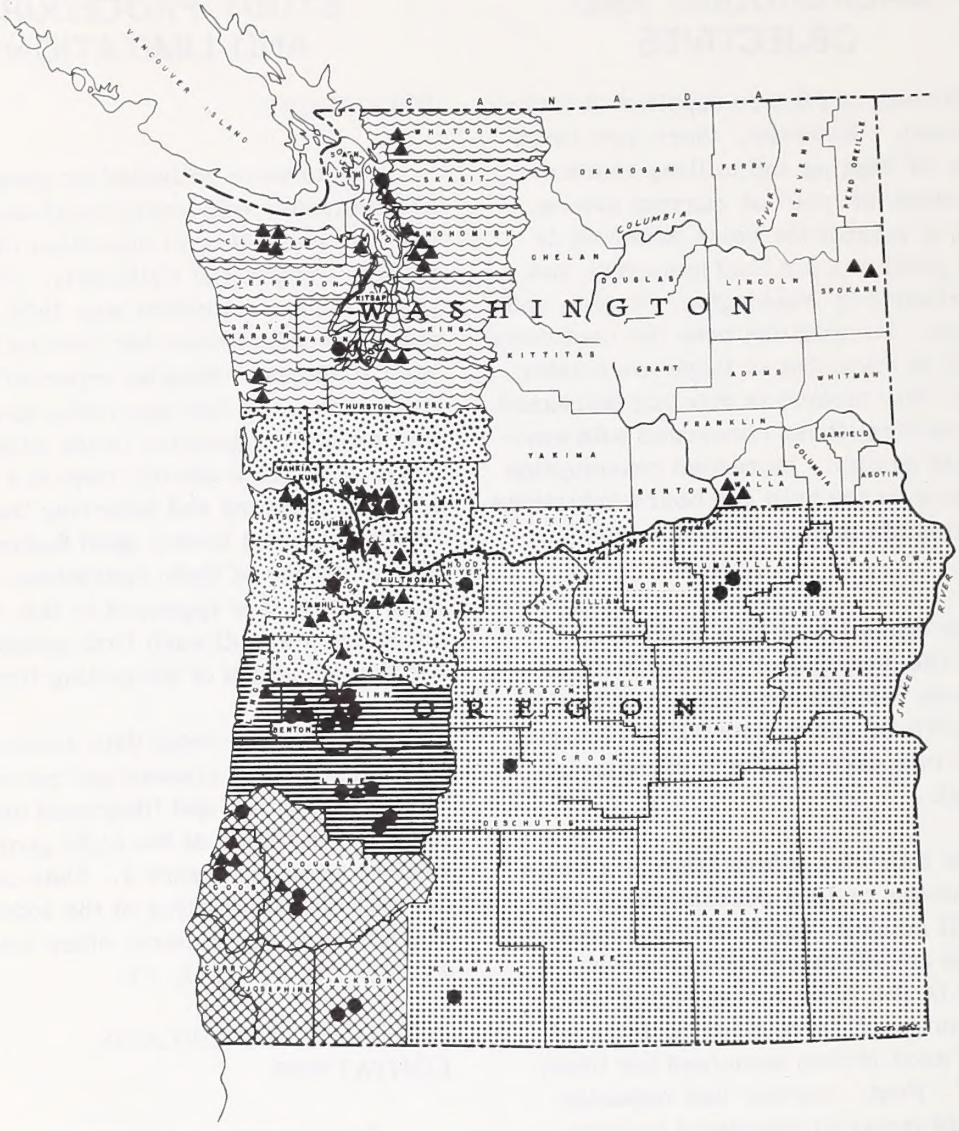
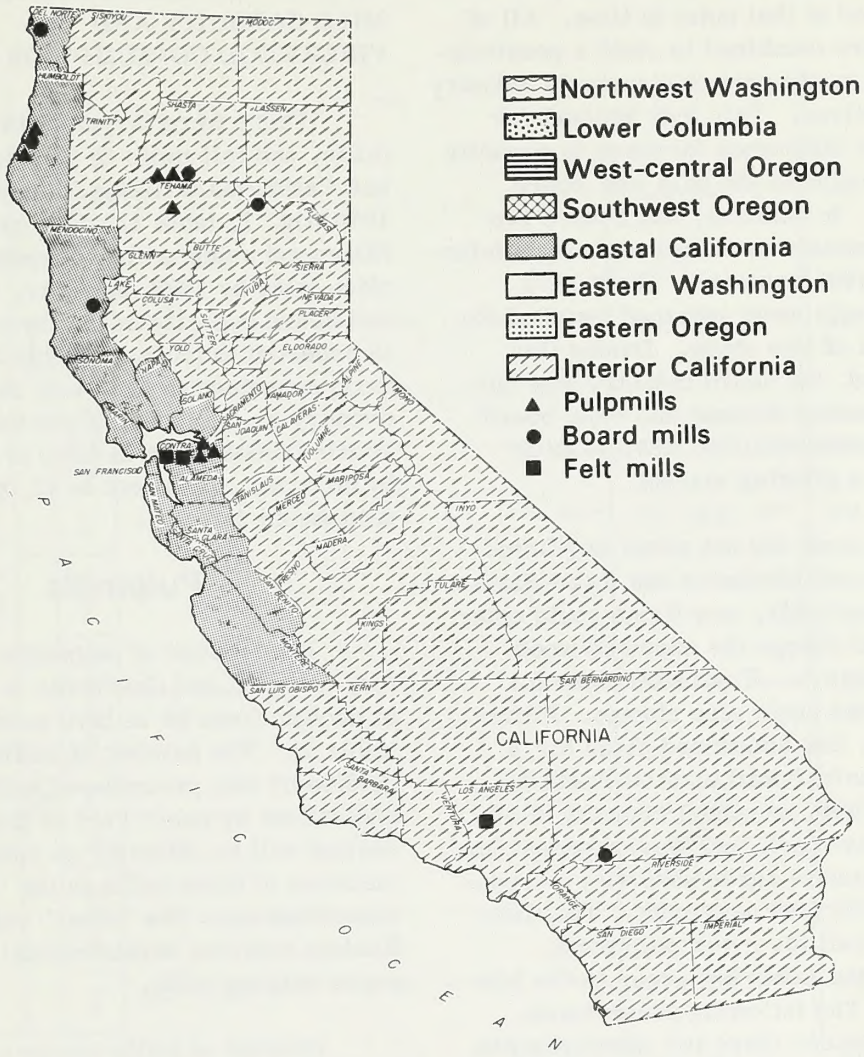


Figure 1.--*Pulp, board, and felt manufacturing areas and mill locations, Washington, Oregon, and California, 1970*


Northwest Washington
Lower Columbia
West-central Oregon
Southwest Oregon
Coastal California
Eastern Washington
Eastern Oregon
Interior California
Pulpmills
Board mills
Felt mills
CALIFORNIA
SAN FRANCISCO
LOS ANGELES
SAN DIEGO
RIVERSIDE
SAN BERNARDINO
IMPERIAL
KERN
TULARE
KINGS
FRESNO
MADERA
MARIPOSA
INYO
MERCED
SAN LUIS OBISPO
SANTA BARBARA
VENTURA
ORANGE
SAN BENITO
SANTA CLARA
ALAMEDA
CONTRA COSTA
SAN JOAQUIN
CALAVERAS
TUOLUMNE
AMADOR
ALPINE
MONO
STANISLAUS
SACRAMENTO
YOLO
SOLANO
NAPA
SONOMA
MENDOCINO
LAKE
COLUSA
GLENN
BUTTE
SIERRA
NEVADA
PLACER
EL DORADO
YUBA
SUTTER
TEHAMA
SHASTA
LASSEN
MODOC
TRINITY
HUMBOLDT
DEL NORTE
SISKIYOU
PACIFIC OCEAN

the all-time high debts paper companies had incurred at that point in time. All of these factors combined to yield a pessimistic outlook on the part of many pulp industry representatives. This may account for some of the difference foreseen in capacity expansion between the pulp and board industries. In addition, there were two pulp companies who did not contribute information on 1980 capacity. Their 1970 capacity levels were assumed constant for the purpose of this study. During this same period, the board industry was facing an expanding demand and most board industry representatives were looking forward to a growing market.

This study did not cover any firms not already established in the three-State area. Conceivably, new firms could enter the area and change the expected wood fiber use pattern. Expansion plans for existing firms could also change. Fibreboard Corp. has announced plans for a medium density board plant at Rocklin, California, with an annual capacity of 60 million square feet, and Weyerhaeuser has signed a tentative agreement with a Japanese firm to furnish newsprint. This later action may call for a new pulp plant, possibly in the Longview area, in the late seventies. The following presentation does not consider these two developments.

PRESENT AND PROSPECTIVE PULP, BOARD, AND FELT INDUSTRY CAPACITY

Capacity is the base for present and future wood consumption. This section discusses present and potential fiberwood using capacity and the limits to capacity expansion. Combined data for the pulp, board, and felt industries are presented first, and then each industry is discussed.

WHAT IS THE EXPECTED 1980 MILL CAPACITY AND FIBERWOOD CONSUMPTION ?

There were 92 pulpmills, board mills, and felt mills in Washington, Oregon, and California utilizing fiberwood[1/] in 1970 (fig. 1, table 1). The number of fiberwood using mills is expected to decline to 86 by 1980; however, total pulp and board capacity in the three-State area is expected to increase (table 2). Total wood consumed in 1970 was 14,855,000 ovendry (O. D.) tons, [2/] and total expected yearly consumption in 1980 is expected to increase 19 percent to 17,658,000 O. D. tons (table 3).

Pulpmills

The number of pulpmills in Washington, Oregon, and California is expected to decline from 56 in 1970 to 49 in 1980 (table 1). The number of sulfite mills will decline by six; groundwood mills by three; and sulfate by one. Part of this overall decline will be offset by an anticipated increase of three mills in the "other" pulp classification. The "other" pulp classification contains semichemical and wastepaper pulping mills.

Number of mills can be a misleading factor while capacity figures give a better feeling of the industry's size. Looking at number of mills and capacity figures together indicates that the trend toward larger but fewer pulpmills will continue.

[1/] Fiberwood is defined as roundwood logs, chips, sawdust, shavings, and other logging and milling residues suitable for use by pulp, board, and felt plants as a raw material.

[2/] An ovendry ton is 2,000 pounds of fiberwood that has been dried to a constant weight at a temperature of 105° C.

Table 1.—Current and prospective number of mills by type of mill, area, and State, 1970 and 1980

Area and State	Year	Total	Type of mill[1/]									
			Pulp					Board				Felt
			All	Sulfate	Sulfite	Groundwood	Other	All	Hard-board[2/]	Particle board	Insulation board	
Northwest Washington	1970	19	17	4	8	4	1	2	1	--	1	--
	1980	15	13	3	5	3	2	2	1	--	1	--
Lower Columbia	1970	21	17	5	5	5	2	4	2	1	1	--
	1980	19	16	5	4	5	2	3	2	--	1	--
West-central Oregon	1970	15	5	4	1	--	--	10	3	7	--	--
	1980	16	7	4	1	--	2	9	3	6	--	--
Southwest Oregon	1970	10	4	1	1	--	2	6	1	5	--	--
	1980	10	3	1	--	--	2	7	2	5	--	--
Coastal California	1970	10	5	3	--	1	1	3	1	2	--	2
	1980	10	4	3	--	--	1	4	1	3	--	2
Eastern Washington	1970	5	5	1	1	1	2	--	--	--	--	--
	1980	4	4	1	--	1	2	--	--	--	--	--
Eastern Oregon	1970	5	--	--	--	--	--	5	2	2	1	--
	1980	5	--	--	--	--	--	5	2	3	--	--
Interior California	1970	7	3	1	--	2	--	3	--	3	--	1
	1980	7	2	1	--	1	--	4	--	4	--	1
Washington	1970	33	30	8	11	6	5	3	1	1	1	--
	1980	26	24	7	6	5	6	2	1	--	1	--
Oregon	1970	42	18	7	5	4	2	24	8	14	2	--
	1980	43	19	7	4	4	4	24	9	14	1	--
California	1970	17	8	4	--	3	1	6	1	5	--	3
	1980	17	6	4	--	1	1	8	1	7	--	3
Total, west coast	1970	92	56	19	16	13	8	33	10	20	3	3
	1980	86	49	18	10	10	11	34	11	21	2	3

[1/] Each process at a multiplant location is considered an individual mill.

[2/] Includes "fiberboard."

Table 2.—Current and prospective installed 24-hour capacity of pulpmills, board mills, and felt mills by type of mill, area, and State, 1970 and 1980

Area and State	Year	Type of mill								
		Pulp					Board			Felt
		All	Sulfate	Sulfite	Ground wood	Other[1/]	Hardboard, 1/8-inch[2/]	Particle board, 3/4-inch	Insulation board, 1/2-inch	
		O.D. tons					1,000 square feet			O.D. tons
Northwest Washington	1970	5,539	1,767	3,055	673	44	160	--	300	--
	1980	5,349	1,754	2,806	648	141	160	--	390	--
Lower Columbia	1970	7,239	4,322	1,327	1,184	406	520	42	400	--
	1980	8,370	5,624	1,074	1,264	408	520	--	480	--
West-central Oregon	1970	2,888	2,799	89	--	--	1,267	1,135	--	--
	1980	3,565	3,070	89	--	406	2,314	1,582	--	--
Southwest Oregon	1970	844	529	82	--	233	639	945	--	--
	1980	910	530	--	--	380	928	1,803	--	--
Coastal California	1970	1,888	1,578	--	60	250	950	371	--	160
	1980	2,088	1,788	--	--	300	1,000	587	--	172
Eastern Washington	1970	770	415	36	74	245	--	--	--	--
	1980	888	519	--	74	295	--	--	--	--
Eastern Oregon	1970	--	--	--	--	--	904	416	460	--
	1980	--	--	--	--	--	934	905	490	--
Interior California	1970	270	140	--	130	--	--	438	--	300
	1980	220	140	--	80	--	--	1,150	--	322
Washington	1970	10,374	5,102	3,778	799	695	160	42	300	--
	1980	11,193	6,395	3,180	774	844	160	--	390	--
Oregon	1970	6,906	4,730	811	1,132	233	3,330	2,496	860	--
	1980	7,889	5,102	789	1,212	786	4,696	4,290	970	--
California	1970	2,158	1,718	--	190	250	950	809	--	460
	1980	2,308	1,928	--	80	300	1,000	1,737	--	494
Total, west coast	1970	19,438	11,550	4,589	2,121	1,178	4,440	3,347	1,160	460
	1980	21,390	13,425	3,969	2,066	1,930	5,856	6,027	1,360	494

[1/] Includes 138 tons per 24 hours of wastepaper pulping capacity in 1970 and 291 tons per 24 hours in 1980.

[2/] Includes "fiberboard."

Table 3.—Current and prospective volume and form of raw material for pulpmills, board mills, and felt mills by area and State, 1970 and 1980

(1,000 ovendry tons)

Area and State	Year	Form of raw material															
		All fiber-wood	Roundwood					Residues									Waste-paper
			All	No. 3 saw logs	Utility grade logs	8-foot bolts	Other	All	Chips	Peeler cores	Sawdust	Shavings	Bark	Plywood trim	Wood flour	Remanu-facturing waste	
Northwest Washington	1970	4,038	1,983	328	1,440	215	--	2,055	1,786	208	56	5	--	--	--	--	11
	1980	3,623	1,752	250	1,291	211	--	1,871	1,793	--	66	12	--	--	--	--	35
Lower Columbia	1970	4,661	939	410	526	--	3	3,722	3,178	--	526	17	--	1	--	--	--
	1980	5,375	1,129	410	716	--	3	4,246	3,484	--	754	8	--	--	--	--	--
West-central Oregon	1970	2,426	130	--	130	--	--	2,296	1,625	--	284	359	--	26	--	2	20
	1980	3,099	73	--	73	--	--	3,026	1,999	--	348	414	30	229	--	6	30
Southwest Oregon	1970	985	67	20	--	--	47	918	442	--	53	423	--	--	--	--	34
	1980	1,792	76	--	--	--	76	1,716	428	--	193	547	177	371	--	--	55
Coastal California	1970	1,712	94	--	77	--	17	1,618	1,372	--	23	108	--	--	5	110	5
	1980	2,122	130	--	130	--	--	1,992	1,382	--	40	264	--	--	6	300	5
Eastern Washington	1970	427	4	--	4	--	--	423	399	--	24	--	--	--	--	--	7
	1980	493	--	--	--	--	--	493	450	--	43	--	--	--	--	--	7
Eastern Oregon	1970	325	--	--	--	--	--	325	98	--	20	202	--	5	--	--	--
	1980	580	--	--	--	--	--	580	59	2	53	451	--	15	--	--	--
Interior California	1970	281	6	--	6	--	--	275	228	15	14	4	--	--	7	7	117
	1980	574	20	--	20	--	--	554	190	--	10	338	--	--	8	8	114
Washington	1970	7,150	2,629	496	1,918	215	--	4,521	3,970	208	325	18	--	--	--	--	18
	1980	7,381	2,586	418	1,957	211	--	4,795	4,233	--	550	12	--	--	--	--	42
Oregon	1970	5,712	494	262	182	--	50	5,218	3,558	--	638	988	--	32	--	2	54
	1980	7,581	444	242	123	--	79	7,137	3,980	2	907	1,420	207	615	--	6	85
California	1970	1,993	100	--	83	--	17	1,893	1,600	15	37	112	--	--	12	117	122
	1980	2,696	150	--	150	--	--	2,546	1,572	--	50	602	--	--	14	308	119
Total, west coast	1970	14,855	3,223	758	2,183	215	67	11,632	9,128	223	1,000	1,118	--	32	12	119	194
	1980	17,658	3,180	660	2,230	211	79	14,478	9,785	2	1,507	2,034	207	615	14	314	246

In 1970, pulpmills in the three States had a 24-hour capacity of 19,438 O. D. tons (table 2). By 1980, this is expected to increase by at least 10 percent to 21,390 O. D. tons. This is an annual rate of capacity increase of just under 1 percent, well below the 1.5 to 2.5 percent projected for the pulp and paper industry across the Nation. Sulfate and "other" pulp capacity will rise while sulfite and groundwood capacity will decline as shown in figure 2.

Sulfate production is expected to expand due to the process's economies of operation and its versatility in use of species. In addition, many products formerly feasible only through sulfite pulping can now be produced via the sulfate process. The planned decline in sulfite capacity was attributed to rising pollution control costs and lack of wood species versatility. The more obsolete and smaller sulfite operations are finding it uneconomical to bear pollution control costs. In addition, necessary dependence on whitewoods, cottonwood, and other minor species severely crimps raw material procurement. The decline in sulfite capacity is expected to continue beyond 1980. The expected 64-percent increase in "other" pulp capacity, although from a low base, reflects the growing part semichemical processes and waste-paper pulping are playing in the total pulp picture.

Pulp capacity is expected to increase in all three States, with Oregon

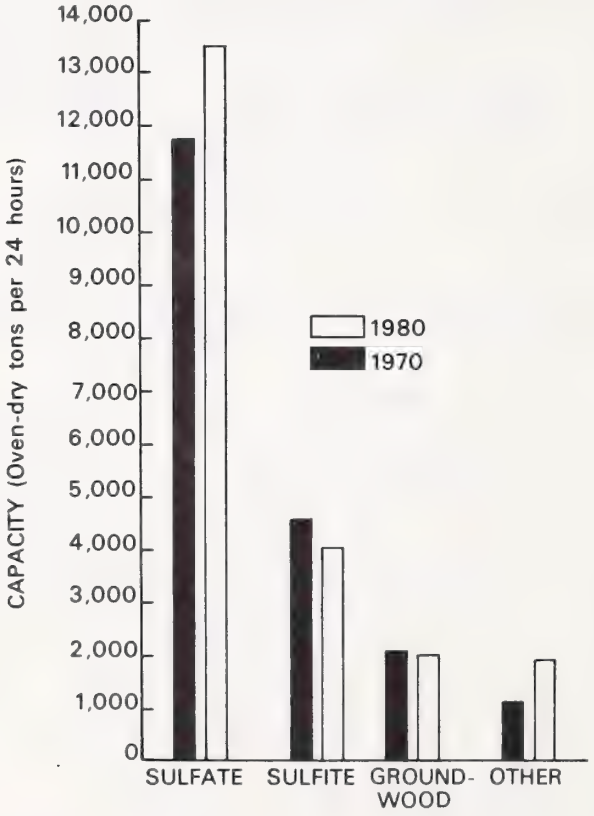


Figure 2.--*Capacity of pulpmills by type of pulp, 1970 and 1980.*

registering both the largest percentage increase, 14 percent, and the largest absolute increase in capacity, 983 O. D. tons per 24 hours. The center of the west coast pulp industry is slowly shifting from Washington to Oregon, following wood supply; however, capacity will increase in all areas, except interior California and northwest Washington. The largest increase will be in the lower Columbia area where capacity will rise by 1,131 tons per day. All of the reported pulp expansion will occur at existing millsites. There is the possibility of a new pulpmill being established near Longview in the late 1970's. If this becomes reality, pulp capacity in the lower Columbia area will grow even more than projected.

Pulpmills in Washington, Oregon, and California consumed 12,831,000 O. D. tons of fiberwood in 1970 and estimate an increase of 7 percent to 13,736,000 O. D. tons by 1980 (table 4). Pulpmills used 86 percent of total fiberwood consumed in 1970, and planned 1980 consumption amounts to 78 percent of the 1980 total. This decline is due to the expected increased use of fiberwood by the board mills.

Board Mills

There were 33 board mills in Washington, Oregon, and California in 1970: 10 hardboard plants, 20 particle board plants, and three insulation board mills (table 1). The board industry is heavily concentrated in Oregon, with 48 percent of all the board mills located in the west central and southwest Oregon areas. By 1980, a small particle board mill in Washington and an insulation board mill in Oregon will close, and two large, new particle board mills in California and a new hardboard mill in Oregon will be operating. Thus, the number of mills and capacity can be expected to grow. This does not include Fibreboard Corp.'s possible expansion of a medium density 60 million square feet annual capacity board mill at Rocklin, California.

Hardboard capacity will grow 32 percent from 4.4 million square feet, 1/8-inch basis, in 1970 to 5.9 million square feet in 1980 (table 2). Particle board capacity is expected to increase from 3.3 million square feet, 3/4-inch basis, in 1970 to 6.0 million square feet in 1980, a rise of 80 percent. Insulation board capacity will increase 17 percent to 1.4 million square feet, 1/8-inch basis. The largest increases are in the Oregon hardboard and particle board capacities and in particle board capacity in California. Board mills utilized 2.0 million O. D. tons of wood in 1970 and expect to increase consumption 96 percent to 3.9 million tons by 1980 (table 5). Board mills accounted for 13 percent of total 1970 fiberwood consumption and will account for 22 percent in 1980.

Felt Mills [3/]

In 1970, there were three felt mills, all in California, which reported utilizing wood (table 1). These three mills had a total capacity of 460 O. D. tons per 24 hours in 1970 and expect this to increase to 494 tons by 1980 (table 2). Fiberwood consumption was 41,000 O. D. tons in 1970 and is expected to rise to 45,000 O. D. tons by 1980. Felt mills can replace wood with wastepaper in their operations but prefer using some wood in the raw material mix, because wood gives the felt a desired absorbent quality.

[3/] Mills producing building or roofing felts, either saturated or unsaturated, in which wood fiber is used.

Table 4.—Current and prospective[1] volume and form of raw material used by pulpmills and felt mills, by area and State, 1970 and 1980

(1,000 ovendry tons)

Area and State	Year	Form of raw material												
		All fiber-wood	Roundwood					Residues						Waste-paper
			All	No. 3 saw logs	Utility grade logs	8-foot bolts	Other	All	Chips	Peeler cores	Sawdust	Wood flour	Remanu-facturing waste	
Pulpmills:														
Northwest Washington	1970	3,994	1,983	328	1,440	215	--	2,011	1,755	208	48	--	--	11
	1980	3,552	1,752	250	1,291	211	--	1,800	1,752	--	48	--	--	35
Lower Columbia	1970	4,562	932	410	522	--	--	3,630	3,135	--	495	--	--	--
	1980	5,275	1,124	410	714	--	--	4,151	3,445	--	706	--	--	--
West-central Oregon	1970	1,898	130	--	130	--	--	1,768	1,590	--	178	--	--	20
	1980	2,240	65	--	65	--	--	2,175	1,991	--	184	--	--	30
Southwest Oregon	1970	446	67	20	--	--	47	379	373	--	6	--	--	34
	1980	434	76	--	--	--	76	358	348	--	10	--	--	55
Coastal California	1970	1,382	94	--	77	--	17	1,288	1,170	--	8	--	110	--
	1980	1,627	100	--	100	--	--	1,527	1,219	--	8	--	300	--
Eastern Washington	1970	427	4	--	4	--	--	423	399	--	24	--	--	7
	1980	493	--	--	--	--	--	493	450	--	43	--	--	7
Eastern Oregon	1970	--	--	--	--	--	--	--	--	--	--	--	--	--
	1980	--	--	--	--	--	--	--	--	--	--	--	--	--
Interior California	1970	122	6	--	6	--	--	116	116	--	--	--	--	19
	1980	115	20	--	20	--	--	95	95	--	--	--	--	19
Washington	1970	7,093	2,629	496	1,918	215	--	4,464	3,939	208	317	--	--	18
	1980	7,310	2,586	418	1,957	211	--	4,724	4,192	--	532	--	--	42
Oregon	1970	4,234	487	262	178	--	47	3,747	3,313	--	434	--	--	54
	1980	4,684	431	242	113	--	76	4,253	3,794	--	459	--	--	85
California	1970	1,504	100	--	83	--	17	1,404	1,286	--	8	--	110	19
	1980	1,742	120	--	120	--	--	1,622	1,314	--	8	--	300	19
Total, west coast	1970	12,831	3,216	758	2,179	215	64	9,615	8,538	208	759	--	110	91
	1980	13,736	3,137	660	2,190	211	76	10,599	9,300	--	999	--	300	146
California felt mills	1970	41	--	--	--	--	--	41	22	--	--	12	7	103
	1980	45	--	--	--	--	--	45	23	--	--	14	8	100

Table 5.—Current and prospective volume and form of raw material used by board mills, by area and State, 1970 and 1980

(1,000 ovendry tons)

Area and State	Year	Form of raw material											
		All fiber-wood	Roundwood			Residues							
			All	Utility grade logs	Other	All	Chips	Peeler cores	Sawdust	Shavings	Bark	Plywood trim	Remanu-facturing waste
Northwest Washington	1970	44	--	--	--	44	31	--	8	5	--	--	--
	1980	71	--	--	--	71	41	--	18	12	--	--	--
Lower Columbia	1970	99	7	4	3	92	43	--	31	17	--	1	--
	1980	100	5	2	3	95	39	--	48	8	--	--	--
West-central Oregon	1970	528	--	--	--	528	35	--	106	359	--	26	2
	1980	859	8	8	--	851	8	--	164	414	30	229	6
Southwest Oregon	1970	539	--	--	--	539	69	--	47	423	--	--	--
	1980	1,358	--	--	--	1,358	80	--	183	547	177	371	--
Coastal California	1970	303	--	--	--	303	180	--	15	108	--	--	--
	1980	466	30	30	--	436	140	--	32	264	--	--	--
Eastern Washington	1970	--	--	--	--	--	--	--	--	--	--	--	--
	1980	--	--	--	--	--	--	--	--	--	--	--	--
Eastern Oregon	1970	325	--	--	--	325	98	--	20	202	--	5	--
	1980	580	--	--	--	580	59	2	53	451	--	15	--
Interior California	1970	145	--	--	--	145	112	15	14	4	--	--	--
	1980	443	--	--	--	443	95	--	10	338	--	--	--
Washington	1970	57	--	--	--	57	31	--	8	18	--	--	--
	1980	71	--	--	--	71	41	--	18	12	--	--	--
Oregon	1970	1,478	7	4	3	1,471	245	--	204	988	--	32	2
	1980	2,897	13	10	3	2,884	186	2	448	1,420	207	615	6
California	1970	448	--	--	--	448	292	15	29	112	--	--	--
	1980	909	30	30	--	879	235	--	42	602	--	--	--
Total, west coast	1970	1,983	7	4	3	1,976	568	15	241	1,118	--	32	2
	1980	3,877	43	40	3	3,834	462	2	508	2,034	207	615	6

WHAT FACTORS WILL LIMIT CAPACITY EXPANSION?

Each mill was asked to list and rank the factors that would limit production at the present site during the next 10 years. Pulpmills ranked regulations to control air and water pollution as the major limitation, and board mills rated these regulations as a close second (table 6). Cost of controlling pollution from existing plants and concern over forthcoming regulations are slowing investment in new production capacity. Washington pulpmills and papermills in the 1971-73 period had 70 percent of their planned capital spending funds earmarked for air and water protection facilities. Oregon mills, newer than those in Washington, had about 50 percent of their capital investments allocated toward environmental controls, according to the Northwest Pulp and Paper Association. Pollution abatement problems may be worsened by product and type, size, age, and location of plant. Older sulfite pulpmills, which produce fine papers, and small mills are apparently the most concerned about these regulations: older sulfite mills because of the high amounts of pollution produced, per unit of production, and small mills because of the high pollution control costs per unit of output. Cost of treating water wastes varies with the volume of water to be treated, and there are economies of scale in waste treatment that provide definite cost advantages to large dischargers of water waste.

Table 6.—Rank of factors limiting expansion of pulp, board, and felt capacity for period 1970-80, Washington, Oregon, and California[1]

Limit to expansion	Pulpmill					Board mill					Felt mill				
	Importance of limitation					Importance of limitation					Importance of limitation				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	Number of mills														
Competition for wood	6	3	8	1	--	7	3	9	3	2	--	1	--	--	1
Labor availability	--	--	4	1	7	1	1	2	3	1	--	--	--	--	--
Domestic final product competition	16	6	6	--	--	11	4	--	1	--	1	--	--	--	--
Competition from imports	--	3	--	1	--	--	3	3	2	--	--	--	--	--	--
Alternative investment opportunities	6	17	3	6	--	1	4	2	1	--	--	--	--	--	--
Pollution control regulations	25	9	8	1	--	8	4	4	--	2	--	--	--	1	--
Chip exports	--	4	3	4	1	--	3	--	--	1	--	--	--	--	--
Other	--	4	2	1	1	3	2	--	1	--	1	--	1	--	--

1/ Each mill was asked to rank factors limiting expansion from 1 to 5. Not all mills responded to ranking five factors.

Water treatment costs per ton of pulp produced in Washington and Oregon varied from $1.10 to $11.10, and waste treatment added nearly $3 a ton, on the average, to the cost of producing wood-pulp in 1972 (5, p. 57). Products produced are a factor because different products cause different degrees of wastes. Production of high yield, coarse, unbleached paperboard does not develop as much waste per unit of output as the better grades of pulp and paper.

Final product competition was the second most important limitation to expansion of capacity in the three States. Board mills rated this as the most important factor, and pulpmills rated it second. Board mills are worried about both domestic and foreign board competition and foresee the need to be innovative and flexible in their product development to remain competitive in the market. Sweden and Japan have been especially competitive in flat board products.[4/] Pulpmills were concerned mainly with competition from other domestic pulpmills.

Concern for wood supply was rated as the third most limiting factor by board mills. Board mills see the pulp producers as taking more and more of the available chip and sawdust supply, leaving board mills with an ever poorer grade of residues for their raw material. Most board mills, however, do not feel there is any need to consider logging residues as a raw material source for their products. Supplies of dry planer shavings, plywood trim, and sawdust seem adequate to most board manufacturers.

Pulpmills placed alternative investment opportunities as the third most limiting factor. However, it is difficult to pinpoint specific reasons why alternatives might appear better. Alternative investment opportunities may look good because of the following adverse factors in the pulp industry: high cost of wood procurement, pollution abatement problems, costs and problems of maintaining a labor force, or any other combination of factors.

[4/] Products such as underlayment and paneling.

IS PRODUCT MIX SHIFTING IN THE PULP INDUSTRY?

Total production of pulp in 1970 was 6,431,000 O.D. tons. Production by type of pulp is shown below for 1970 and 1980:

Type of pulp	Percent of total production	
	1970	1980
Sulfate	59	63
Sulfite	24	18
Groundwood	11	10
Other	6	9
Total	100	100

Production was allocated to each pulp type on the basis of the percentage distribution of total capacity among pulp types.

The 1970 production was broken down among eight different product classes. Paperboard accounted for most of the pulp—2.1 million tons or 33 percent of the total in 1970. Market pulp was second with 28 percent of total pulp production.

The end product mix for the wood—pulp industry in 1970 was compared with the projected 1980 end product mix because a change in product between 1970 and 1980 might be expected in view of pollution control regulations, and this could mean that fiberwood inputs would be affected. Coarse, unbleached products such as packaging and paperboard contribute lower quantities of waterborne wastes per unit of output

than do products such as printing paper and tissue. However, only minor shifts in product mix are expected, and these shifts should have little effect on fiberwood inputs. The relatively constant product mix is surprising in view of the shift away from sulfite pulping, but perhaps this may be indicative of the increased versatility of the sulfate process. The 1970 and 1980 product mixes are shown below:

Products	Percent of product production 1970	1980
Market pulp	28	25
Printing paper	5	5
Newsprint	10	10
Packaging	15	14
Tissue	8	8
Paperboard	33	36
Construction paper and board	(5/)	--
Other	1	2
All products	100	100

By 1980, the only major change expected in product mix will be a slight shift from market pulp to paperboard production. This will be a result of the desire by firms to market products with the highest possible value. The return on investment is higher for paper products than for market pulp.

PRESENT AND PROSPECTIVE CHARACTERISTICS OF FIBER CONSUMPTION

The previous discussion has established the capacity for future fiberwood consumption. This section presents information on the characteristics of fiberwood which the pulpmills, board mills, and felt mills in the survey expect to consume in 1980.

5/ Less than 1 percent.

The form of the 14,855,000 O. D. tons of fiberwood consumed by pulpmills and board mills in 1970 and the form of the 17,658,000 O. D. tons projected to be consumed in 1980 are shown below:

Form of raw material	1970	1980
	(Percent)	
Roundwood:		
No. 3 saw logs	5	4
Utility grade logs	15	12
8-foot bolts	1	1
Other	1	1
Total roundwood	22	18
Mill residues:		
Chips	61	55
Peeler cores	1	(6/)
Sawdust	7	9
Shavings	8	12
Bark	--	1
Plywood trim	(6/)	3
Wood flour	(6/)	(6/)
Remanufacturing wastes	1	2
Total residue	78	82
Total raw material	100	100

This section will discuss fiberwood obtained first from roundwood logs and then from mill residues.

HOW IS THE USE OF ROUNDWOOD FOR FIBERWOOD EXPECTED TO CHANGE?

Roundwood logs made up 22 percent of 1970 fiberwood consumption and are expected to decline in relative importance to 18 percent by 1980. However, the total quantity used will remain almost constant (table 3, fig. 3). Although the relative importance of Utility grade logs is expected to decline by 1980, only the volume of No. 3 saw logs and 8-foot pulpwood

6/ Less than 1 percent.

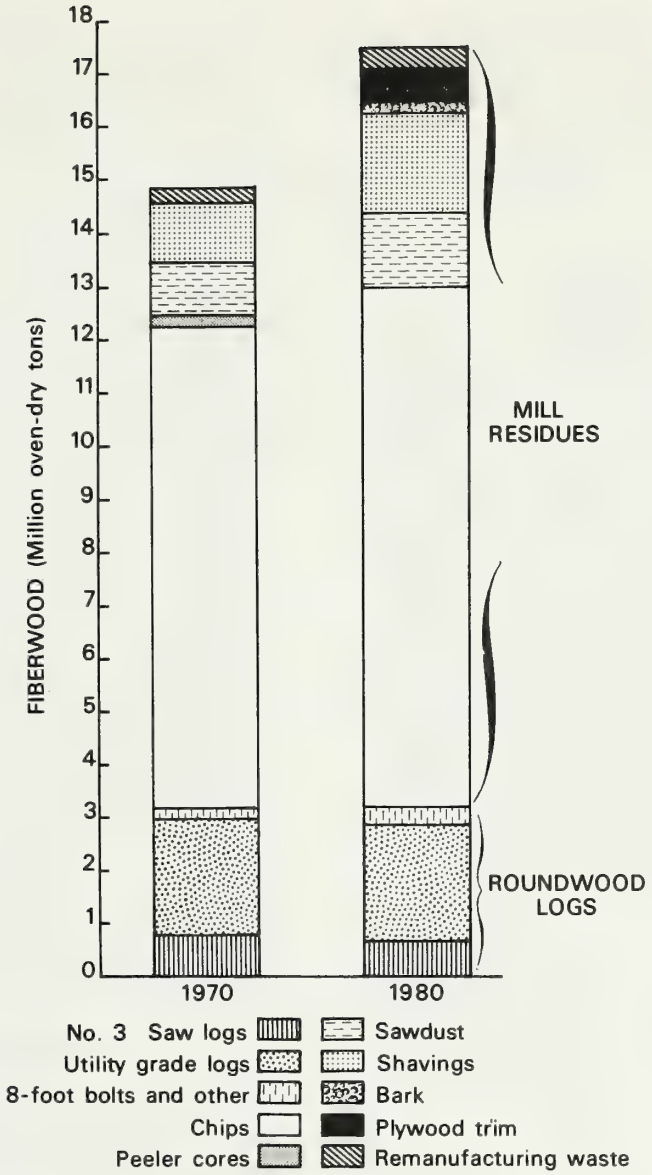


Figure 3.--*Current and expected fiberwood use, Washington, Oregon, and California, 1970 and 1980.*

bolts shows an absolute decrease. It is conceivable that most firms foresee greater use of No. 3 saw logs and 8-foot pulpwood bolts for lumber by 1980. This may be true even for species which have no lumber market today.

Pulpmills

Roundwood fiberwood made up 25 percent of the 12,831,000 O.D. tons of fiberwood consumed in 1970 by pulpmills, with most of this Utility grade logs (table 4). In 1970, 758,000 O.D. tons of No. 3 saw logs were consumed as fiberwood by pulpmills. Most of this material was cottonwood, alder, or other species without a readily available lumber market. No. 3 saw logs that approach being 50-percent merchantable are often pulped, because sawing this material is an inefficient use of sawmill facilities and these logs will often yield 80 percent or more in chip content. Most roundwood logs used for fiberwood are logs used by pulpmills in the northwest Washington or lower Columbia areas.

By 1980, roundwood log usage is expected to decline to 23 percent of total pulpmill fiberwood consumption but remain close to the 3.2 million O.D. tons of roundwood consumed in 1970. The use of Utility logs is expected to remain fairly stable, and the volume of No. 3 saw logs will decline slightly.

In general, pulpmills do not foresee any change in the total quantity of roundwood used in their operations, and the use of chips and sawdust will be increased to supply the expected increase in capacity. This has been the case historically also. Since the late 1940's, pulpmills in Washington and Oregon have been consuming about 3 million tons of logs annually for pulp. During the same period, total pulpwood consumed in the two States has risen from a little over 3 million tons annually to almost 12 million tons. How long roundwood log use will remain around 3 million tons a year is another question.

Although the quantity of Utility grade logs used is expected to remain stable over the next 10 years, many firms in Washington are looking ahead 10-15 years. At that time, all private old growth will have been removed and Utility logs will be available only on Forest Service lands. With this in mind, some firms are not planning on updating their roundwood handling equipment. Instead, they are planning to make existing equipment last until such time as it is necessary to shift to mill residues. Data from individual State studies indicate that 62 percent of the roundwood used by pulpmills in Washington comes from the firms' own lands, with the proportion being even greater in Oregon (*2*, *3*, *7*). As the private supply of Utility logs declines, there will be greater competition for Federal Utility logs. This implies that 10-15 years hence, fiberwood-using firms will be operating entirely on mill and logging residues or on Utility logs from Federal lands.

Board Mills

Roundwood was used by board mills only in the lower Columbia area in 1970 and amounted to 7,000 O.D. tons. By 1980, board mills expect roundwood usage to increase from 7,000 to 43,000 O.D. tons, an increase of 36,000 tons. All this increase will be based on Utility grade logs. However, even with this increase, roundwood will still be a minor portion of total fiberwood use by board mills. Most board mills do not have the capability to handle roundwood logs. This may also have implications for using logging residues in roundwood form.

WHAT ARE THE SOURCES OF SUPPLY FOR ROUNDWOOD FIBERWOOD?

Of the 3,223,000 O. D. tons of roundwood fiberwood consumed in 1970 by pulpmills, board mills, and felt mills, 91 percent came from harvest operations, 5 percent from salvage, and 2 percent each from logging residues and from thinnings (table 7). Mills do not see logging residues as adding greatly to their roundwood supply in the near future. In 1980, mills expect harvest operations to supply 81 percent of their roundwood, salvage 15 percent, logging residues 3 percent, and thinnings 1 percent. Most of the current and expected increase in use of salvage material occurs in the northwest Washington area. Although 1980 roundwood use is expected to decrease by 43,000 O. D. tons to 3,180,000 tons, this is less than a 1-percent decrease. The source of roundwood logs for 1980 compared with 1970 is shown below.

Source of roundwood	1970	1980
	(Percent)	
Thinning or prelogging	2	1
Relogging or logging residues	2	3
Salvage	5	15
Harvest	91	81
Total	100	100

Harvest operations and thinnings or prelogging operations are expected not only to be relatively less important in 1980, but also to furnish less volume in 1980 than they did in 1970.

WHAT ARE CURRENT AND EXPECTED MILL RESIDUE USES?

Mill residues made up 78 percent of 1970 fiberwood consumption and will increase to 82 percent of 1980 fiberwood use. The volume of material used will increase from 11.6 million O. D. tons in 1970 to 14.5 million in 1980. Although the relative importance of chips is expected to decline by 1980, only peeler core volume will show an absolute decrease. Peeler cores are increasingly being sawn for lumber.

Pulpmills

Mill residues accounted for 75 percent or 9.6 million O. D. tons of pulpmill fiberwood consumed in 1970, with chips making up 66 percent of all wood used. Most mill residues used by pulpmills were either chips or sawdust, and pulpmills in the lower Columbia area were the major consumers of this material.

Mill residue use will increase from 75 to 77 percent of total pulpmill fiberwood use in 1980, or 10.6 million O. D. tons. Sawdust consumption is expected to increase 32 percent from 759,000 O. D. tons in 1970 to 999,000 tons in 1980. Increased use of sawdust is somewhat offset by increased use of wastepaper, to be discussed later. Use of remanufacturing waste is expected to increase threefold to 300,000 O. D. tons and the use of peeler cores is expected to drop to zero.

Board Mills

Mill residues made up 1,976,000 O. D. tons of wood used in 1970, shavings accounted for 1,118,000 tons, chips 568,000, sawdust 241,000, and plywood trim, peeler cores, rough slabs and edgings, and remanufacturing wastes made up the remainder.

Mill residue consumption is expected to increase 94 percent by 1980 to 3,834,000 O. D. tons. Fiberwood use by board mills in 1980 is expected to be 96 percent above 1970 wood use, and this implies that use of all forms of material will increase.

Table 7.—Current and prospective source of roundwood consumed by pulpmills and board mills, by area and State, 1970 and 1980

(1,000 ovendry tons)

Area and State	Year	Source of roundwood			
		Thinning or prelogging	Relogging or logging residues	Salvage	Harvest
Northwest Washington	1970	14	28	163	1,778
	1980	12	30	461	1,249
Lower Columbia	1970	32	--	2	905
	1980	31	--	5	1,093
West-central Oregon	1970	--	--	--	130
	1980	--	8	--	65
Southwest Oregon	1970	6	23	--	38
	1980	--	19	--	57
Coastal California	1970	--	--	--	94
	1980	--	30	--	100
Eastern Washington	1970	--	--	4	--
	1980	--	--	--	--
Eastern Oregon	1970	--	--	--	--
	1980	--	--	--	--
Interior California	1970	--	6	--	--
	1980	--	--	--	20
Washington	1970	31	28	169	2,401
	1980	29	30	466	2,061
Oregon	1970	21	23	--	450
	1980	14	27	--	403
California	1970	--	6	--	94
	1980	--	30	--	120
Total, west coast	1970	52	57	169	2,945
	1980	43	87	466	2,584

The percent of chips and shavings used by board mills is expected to decline, and use of bark and plywood trim is expected to increase. Use of bark was almost zero in 1970 and is expected to be 207,000 O.D. tons by 1980. These changes reflect the increased difficulty board operators see in obtaining wood raw material. They feel that in the future they will have to use lower quality inputs if they are going to compete with pulpmills in raw material markets.

WHAT ARE THE SOURCES FOR MILL RESIDUES?

Of the 11.6 million O.D. tons of mill residues consumed in 1970, sawmills supplied 73 percent, veneer and plywood mills 22 percent, roundwood chipping plants 3 percent, and remanufacturing wastes 2 percent (table 8). By 1980, mill residues utilization will amount to 14.5 million tons. Although the quantity of mill residues from each source will increase, sawmills are expected to decrease in relative importance, supplying only 67 percent. The 1970 and 1980 sources of mill residues are compared below:

Source of residues	1970	1980
	(Percent)	
Roundwood chipping plant	3	5
Sawmill residue	73	67
Veneer and plywood residue	22	24
Remanufacturing waste	2	4
Total	100	100

The share supplied by roundwood chipping plants may reflect material from harvest cuts, thinnings, or logging residues. To the extent this is so, figures on the use of these roundwood residues are understated. There has not been complete satisfaction with chips obtained from roundwood chippers. This material has contained a higher portion of contaminants than most mills like. Future use of material from this source will depend partially on the ability of roundwood chipping plants to produce a more homogeneous product.

The source of mill residues for pulpmills closely followed the above pattern. Pulpmills obtained 71 percent of their 1970 mill residue supply from sawmills (table 9). Veneer and plywood operations supplied 25 percent, roundwood chipping plants 3 percent, and remanufacturing plants 1 percent. Residue use by 1980 is expected to increase 10 percent to 10,599,000 O.D. tons, and sawmills are expected to supply 68 percent of that amount.

Board mills differed in their source of residues, obtaining 1.7 million O.D. tons or 84 percent of their 1970 residue use from sawmills. Veneer and plywood residue and remanufacturing waste supplied most of the balance (table 10). The source of residues used by board mills is expected to change by 1980, with sawmill residues declining in importance and veneer and plywood and remanufacturing residue increasing in importance.

All sources will supply a larger volume of material to the board industry in 1980 than they did in 1970. This is due to the absolute increase in wood use expected to occur in the industry. There is some concern within the board industry that the use of abrasive planers will become standard. If this were to happen, shavings would disappear as a source of fiberwood, and board mills would be forced to be more competitive with pulpmills for chipped material or perhaps turn to logging residues to supply their needs.

DOES ROUNDWOOD FIBERWOOD DIFFER IN SPECIES MAKEUP FROM MILL RESIDUE FIBERWOOD?

Pulpmills, board mills, and felt mills reported that 58 percent of their 1970 mill residue fiberwood consumption was Douglas-fir, and whitewood consumption was 24 percent of the total (table 11). Use of whitewood residue was concentrated in the northwest Washington and lower Columbia areas, while Douglas-fir residue use was concentrated in the lower Columbia and west-central

Table 8.—Current and prospective source of mill residues used by pulpmills, board mills, and felt mills, by area and State, 1970 and 1980

(1,000 ovendry tons)

Area and State	Year	Source of residues			
		Roundwood chipping plant	Sawmill residue	Veneer and plywood residue	Remanufacturing waste
Northwest Washington	1970	216	1,557	282	--
	1980	308	1,410	153	--
Lower Columbia	1970	9	2,785	928	--
	1980	9	3,221	1,008	8
West-central Oregon	1970	11	1,428	855	2
	1980	247	1,644	1,129	6
Southwest Oregon	1970	16	779	113	10
	1980	57	1,129	519	11
Coastal California	1970	48	1,234	216	120
	1980	69	1,280	281	362
Eastern Washington	1970	--	264	159	--
	1980	--	246	247	--
Eastern Oregon	1970	--	223	10	92
	1980	--	309	72	199
Interior California	1970	--	226	28	21
	1980	--	380	114	60
Washington	1970	225	3,347	949	--
	1980	317	3,643	835	--
Oregon	1970	27	3,689	1,398	104
	1980	304	4,316	2,293	224
California	1970	48	1,460	244	141
	1980	69	1,660	395	422
Total, west coast	1970	300	8,496	2,591	245
	1980	690	9,619	3,523	646

Table 9.—Current and prospective source of mill residues consumed by pulpmills and felt mills, by area and State, 1970 and 1980

(1,000 ovendry tons)

Area and State	Year	Source of residues			
		Roundwood chipping plant	Sawmill residue	Veneer and plywood residue	Remanufacturing waste
Pulpmills:					
Northwest Washington	1970	216	1,535	260	--
	1980	308	1,371	122	--
Lower Columbia	1970	9	2,698	923	--
	1980	9	3,168	974	--
West-central Oregon	1970	11	946	811	--
	1980	223	1,073	879	--
Southwest Oregon	1970	16	334	29	--
	1980	55	271	32	--
Coastal California	1970	48	906	216	118
	1980	44	962	269	252
Eastern Washington	1970	--	264	159	--
	1980	--	246	247	--
Eastern Oregon	1970	--	--	--	--
	1980	--	--	--	--
Interior California	1970	--	116	--	--
	1980	--	95	--	--
Washington	1970	225	3,312	927	--
	1980	317	3,603	804	--
Oregon	1970	27	2,465	1,255	--
	1980	278	2,526	1,450	--
California	1970	48	1,022	216	118
	1980	44	1,057	269	252
Total, west coast	1970	300	6,799	2,398	118
	1980	639	7,186	2,523	252
California felt mills	1970	--	32	--	9
	1980	--	35	--	11

Table 10.—Current and prospective source of mill residues used by board mills, by area and State, 1970 and 1980

(1,000 ovendry tons)

Area and State	Year	Source of residues			
		Roundwood chipping plant	Sawmill residue	Veneer and plywood residue	Remanufacturing waste
Northwest Washington	1970	--	22	22	--
	1980	--	39	31	--
Lower Columbia	1970	--	87	5	--
	1980	--	53	34	8
West-central Oregon	1970	--	482	44	2
	1980	24	571	250	6
Southwest Oregon	1970	--	445	84	10
	1980	2	858	487	11
Coastal California	1970	--	303	--	--
	1980	25	291	12	108
Eastern Washington	1970	--	--	--	--
	1980	--	--	--	--
Eastern Oregon	1970	--	223	10	92
	1980	--	309	72	199
Interior California	1970	--	103	28	14
	1980	--	277	114	51
Washington	1970	--	35	22	--
	1980	--	40	31	--
Oregon	1970	--	1,224	143	104
	1980	26	1,790	843	224
California	1970	--	406	28	14
	1980	25	568	126	159
Total, west coast	1970	--	1,665	193	118
	1980	51	2,398	1,000	383

Table 11.—Consumption of mill residues by pulpmills, board mills, and felt mills, by species, area, and State, 1970

(1,000 ovendry tons)

Area and State	Softwoods							Hardwoods
	All	Whitewoods	Douglas-fir	Pine	Redwood	Cedar	Other or unknown	
Northwest Washington	2,052	1,087	790	21	--	37	117	3
Lower Columbia	3,666	1,071	2,221	306	--	56	12	56
West-central Oregon	2,296	134	2,149	12	--	1	--	--
Southwest Oregon	901	200	528	173	--	--	--	17
Coastal California	1,614	108	813	108	466	1	118	4
Eastern Washington	423	57	154	193	--	--	19	--
Eastern Oregon	325	98	44	183	--	--	--	--
Interior California	275	68	48	128	--	17	14	--
Washington	4,462	1,532	2,358	343	--	93	136	59
Oregon	5,201	1,115	3,528	545	--	1	12	17
California	1,889	176	861	236	466	18	132	4
Total, west coast	11,552	2,823	6,747	1,124	466	112	280	80

Oregon areas. Individual State studies reported that 1968 roundwood consumption by the pulpmills and board mills was 83 percent whitewoods, 4 percent Douglas-fir, and 12 percent hardwoods (*2*, *3*, *7*). The percent by species for mill and roundwood fiberwood is shown below:

Species	Mill residue	Roundwood
	(Percent)	
Whitewoods	24	83
Douglas-fir	58	4
Pine	10	--
Redwood	4	--
Cedar	1	1
Other softwood or unknown	2	--
Hardwoods	1	12
Total	100	100

The difference in species content between mill residues and roundwood stems from the need for long fibered whitewoods, mainly in sulfite operations, and the economic incentive to use low value hardwoods. Because not enough of the whitewood mill residues are available to meet their needs, sulfite pulpmills obtain some of it in log form. The large volumes of hardwood logs available without a lumber market make this an economical source of fiberwood for those firms that have roundwood processing capabilities and produce products allowing use of the short-fibered hardwood.

With the expected decline in sulfite pulping and an almost constant planned use of roundwood fiberwood between 1970 and 1980, it seems likely that future roundwood supplies will be distributed more evenly among species. Use of Douglas-fir Utility logs will probably increase, and use of whitewood logs will decline.

Douglas-fir residues made up 59 percent or 5,672,000 O.D. tons of the mill residues consumed by pulpmills in 1970 (table 12). Whitewoods were second with 25 percent. Board mills reported that 54 percent of the residues they consumed in 1970 were Douglas-fir (table 13). The breakdown of residue usage by species was as follows:

Species	Pulpmills	Board mills
	(Percent)	
Douglas-fir	59	54
Whitewoods	25	19
Pine	8	20
Redwood	3	6
Cedar	1	1
Other softwoods or unknown	3	--
Hardwoods	1	--
Total	100	100

The decline in sulfite pulping and the increase in board production should have negligible effect on the species used for fiberwood in the future, but this decline may modify somewhat where various species are used. Whitewood species will now be utilized closer to where grown than previously. Another aspect of this is that the price differential paid for whitewood chips can be expected to decline. This is a natural result of a slackening in the demand for whitewoods.

IS THERE A CONNECTION BETWEEN WASTEPAPER AND WOOD FIBER USE?

Wastepaper usage is an interesting area of concern. Wastepaper and sawdust serve the same role in pulp production, i.e., act as a filler. To the extent mills expand the use of wastepaper, they will not use sawdust. Some mills report the need to use wastepaper stems from government contracts which require a certain amount of recycled paper for some products. Evidently, either sawdust or wastepaper use in a given mill can be expanded, but not both.

Wastepaper use by pulpmills which also used wood fiber was reported at 91,000 O.D. tons in 1970 and felt mills used 103,000 tons (table 4). This is expected to increase to 146,000 tons for pulpmills by 1980, a 60-percent increase, and decline to 100,000 tons for felt mills. However, these figures do not indicate total wastepaper consumption in the three-State area, because there are some mills operating on wastepaper and market pulp that did not utilize wood fiber and therefore were not included in this study. Board mills did not use any wastepaper.

HOW DEPENDENT WERE PULPMILLS AND BOARD MILLS ON OPEN MARKET SOURCES FOR MILL RESIDUE?

Pulpmills in Washington, Oregon, and California reported purchasing from outside their firms 6.3 million O.D. tons of mill residue--65 percent of their mill residue consumption in 1970 (table 14). California pulpmills purchased 74 percent of their residues, Washington firms 68 percent, and Oregon firms 59 percent. By area, coastal California was most dependent on purchased mill residues, and mills in southwest Oregon obtained all but 27 percent of their mill residue input from within their own firms. The percent purchased on the market by area is shown in figure 4.

Board mills were more dependent on purchased raw material than were pulpmills, purchasing 69 percent of their wood input on the open market (table 14). The operations in northwest Washington obtained all their material from within their own corporations, and mills on the Columbia River were most dependent on purchased material.

Table 12.—Consumption of mill residues by pulpmills and felt mills by species, area, and State, 1970

(1,000 ovendry tons)

Area and State	Softwoods							Hardwoods
	All	Whitewoods	Douglas-fir	Pine	Redwood	Cedar	Other or unknown	
Pulpmills:								
Northwest Washington	2,008	1,076	757	21	--	37	117	3
Lower Columbia	3,574	1,064	2,136	306	--	56	12	56
West-central Oregon	1,768	59	1,698	11	--	--	--	--
Southwest Oregon	362	55	243	64	--	--	--	17
Coastal California	1,284	99	655	92	320	--	118	4
Eastern Washington	423	57	154	193	--	--	19	--
Eastern Oregon	--	--	--	--	--	--	--	--
Interior California	116	28	29	44	--	15	--	--
Washington	4,404	1,518	2,314	343	--	93	136	59
Oregon	3,731	793	2,674	252	--	--	12	17
California	1,400	127	684	136	320	15	118	4
Total, west coast	9,535	2,438	5,672	731	320	108	266	80
California felt mills	41	--	2	--	24	1	14	--

Table 13.—Consumption of mill residues by board mills, by species, area, and State, 1970

(1,000 ovendry tons)

Area and State	Softwoods							Hardwoods
	All	Whitewoods	Douglas-fir	Pine	Redwood	Cedar	Other or unknown	
Northwest Washington	44	11	33	--	--	--	--	--
Lower Columbia	92	7	85	--	--	--	--	--
West-central Oregon	528	75	451	1	--	1	--	--
Southwest Oregon	539	145	285	109	--	--	--	--
Coastal California	303	9	156	16	122	--	--	--
Eastern Washington	--	--	--	--	--	--	--	--
Eastern Oregon	325	98	44	183	--	--	--	--
Interior California	145	40	19	84	--	2	--	--
Washington	58	14	44	--	--	--	--	--
Oregon	1,470	322	854	293	--	1	--	--
California	448	49	175	100	122	2	--	--
Total, west coast	1,976	385	1,073	393	122	3	--	--

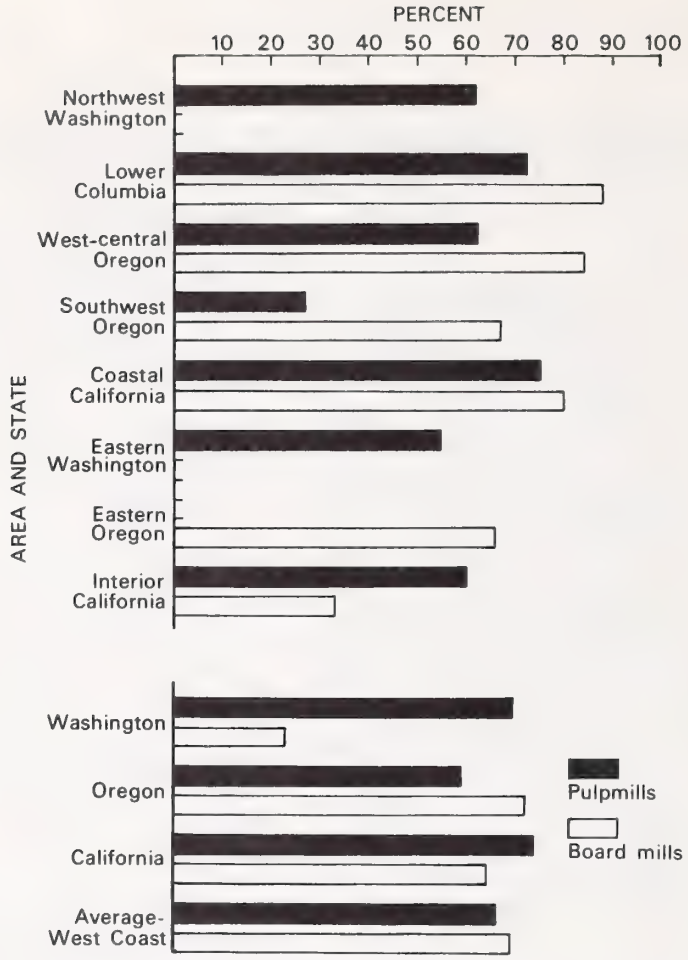


Figure 4.--*Percent of mill residues purchased outside of firm by area and State, 1970.*

Table 14.—Volume of mill residues obtained outside of firm, by type of mill, area, and State, 1970

(1,000 ovendry tons)

Area and State	Type of mill			
	Total	Pulp	Board	Felt
Northwest Washington	1,247	1,247	--	--
Lower Columbia	2,676	2,595	81	--
West-central Oregon	1,455	1,089	366	--
Southwest Oregon	523	102	421	--
Coastal California	1,231	964	240	27
Eastern Washington	231	231	--	--
Eastern Oregon	211	--	211	--
Interior California	131	69	48	14
Washington	3,070	3,057	13	--
Oregon	3,273	2,207	1,066	--
California	1,362	1,033	288	41
Total, west coast	7,705	6,297	1,367	41

The dependency of board mills on purchased fiberwood again highlights the fact that board mills will have to compete more and more with pulpmills for their raw material needs. The fact that most board mills are located in areas with high volumes of old-growth timber may mean that as competition for mill residues grows, more use will be made of the large volumes of logging residues available. Board mills have given some thought about going to logging residues for a source of fiberwood. Currently, however, there does not seem to exist the necessary logging and processing equipment to economically and efficiently handle this kind of material.

WHAT ARE CURRENT PULPMILL ROUNDWOOD SPECIFICATIONS AND WHAT CHANGES CAN BE EXPECTED?

Roundwood log specifications currently used by pulpmills vary by type of pulp produced and log handling equipment available to the firm. Most firms reported the minimum diameter acceptable as 6 inches; however, a few firms will take down to 4-inch logs. Average maximum log diameter allowed is in the 40- to 48-inch area for most firms, with the range in maximum diameter limits from 30 inches to no limit at all. Minimum log length ranged from 8 to 16 feet, with most firms accepting down to 12 feet. Maximum length is usually given as 40 feet. Minimum sound chippable material required in the log ranged from 50 to 95 percent, with most mills accepting logs containing 50-percent chippable material. Other standard requirements are that no char will be allowed that cannot be removed by debarker, there can be no excessive crook, knots, or other abnormalities, and logs must be delimbed. Species use depended on the individual mill, and everything from black cottonwood to incense-cedar was used. Although some mills felt current specifications were so lenient that future roundwood specifications would not change, many mills did feel that future specifications would allow a larger number of species and perhaps smaller diameter logs. An increased usage of alder and pine was specifically mentioned as to be expected.

HOW DO PULPMILL SPECIFICATIONS FOR MILL RESIDUES VARY?

Pulpmill chip specifications usually require the chip to pass through, or be retained on, various sizes of screens. In addition, there are usually char, bark, rot, stain, moisture, and species limitations. Chips are usually required to be cut with the grain and with the chip ends being cut clean showing little or no breakage. Mills reported an average chip size of 3/4 inch with 91 percent of the chips being retained on screens between the sizes 1 inch and 3/16 inch. These figures differ slightly from an American Pulpwood Association study that indicated the average chip is retained on a 3/8-inch screen and approximately 91 percent of the chips are retained on screens from 7/8 inch to 3/16 inch in size (table 15). Maximum bark content allowance was 0.38 compared with 0.54 percent found in our study. Most of the mills contacted required that the chips be substantially free of rot without specifying a percent allowance. Most mills would accept a small but unspecified amount of stain and white speck. Other specifications required the chips to be free of char or burned materials and free of foreign material such as needles and dirt. Most of the mills would not accept chips from kiln-dried wood, and several required a moisture content of between 40 and 80 percent. Dry chips absorb too much chemical in processing, and reestablishing the moisture content in kiln-dried wood results in a high falldown in yield.

Table 15.—Pulpmill chip specifications; percent of chips retained on various screen sizes and percent of allowable bark and rot in chips by mill[1]

Screen size (inches)	Pulpmill													
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14
1-1/2	--	--	--	1	--	--	--	--	--	--	--	1	--	--
1-3/8	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1-1/4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1-1/8	4	--	4	--	4	10	--	4	5	4	--	4	4	5
1	--	5	--	--	--	--	3	--	--	--	5	--	--	--
7/8	18	--	18	--	18	--	--	18	--	18	10	--	18	--
3/4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5/8	--	--	--	--	--	--	--	--	--	--	40	--	--	--
1/2	--	70	--	--	--	--	--	--	--	--	--	83	--	--
3/8	55	--	55	--	55	--	--	55	--	55	30	--	55	--
1/4	--	20	--	5	--	--	--	--	--	--	--	5	--	--
3/16 (Pin)	18	5	18	--	18	3	3	18	10	18	10	6.5	18	90
Pan (Fines)	4	--	4	--	4	--	--	4	5	4	5	.5	4	5
Maximum bark allowance	.5	.5	.5	.5	.3	.5	.5	.15	.2	.15	.5	.2	.5	.3
Maximum rot allowance	.15	--	1.0	1.0	5.0	1.0	--	1.0	1.0	5.0	.5	.1	--	--

1/ Source: American Pulpwood Association.

A few mills, however, would take wood of any moisture content.

Most of the pulpmills have a preferred species mix, usually based on what they feel is needed for their type of end product. Usually these specifications call for a mix of whitewood and Douglas-fir with an allowance for minor species. There is little expectation of change for chip specifications within the industry. However, six pulpmills did indicate that chip specifications would probably be modified in the near future to allow the use of more dry material, sawdust, and shavings. These firms feel that, even though dry material, sawdust, and shavings yield a lower quality pulp, the cost of this material makes it attractive and technology will be able to offset some of the quality decline.

Pulpmill sawdust specifications call for material substantially free from bark, rot, slivers, or oversized pieces. Usually mills want green wood that has not been kiln or air dried and wood that is free of char or burn. Species requirements are generally not as strict as those for chips; however, certain species such as cedar may still be limited.

WHAT ARE CURRENT AND EXPECTED BOARD MILL FIBERWOOD SPECIFICATIONS?

Board mill chip specifications tend to be more variable than pulpmill specifications. Size limits are wider, with no one size apparently dominating. Rot content is usually limited between 5 and 10 percent maximum, and bark content can

vary from none to 10 percent, but most board mills want chips substantially free of bark. Stain appears to be more of a problem to board mills than it is to pulpmills, because many board mills specified that the chips must be free of stain. Species requirements depend on the desired product density and strength. As an example, hemlock will be used where low density and high strength are needed. Most firms relied mainly on Douglas-fir chips and did not want to mix species of wood used, regardless of the form of wood. When species are mixed, odor and pH factors need to be considered.

Sawdust, as defined by many board mills, is that material passing through a 3/16-inch screen but retained on a 1/8-inch screen. Sawdust specifications by board mills usually call for a maximum of 0 to 10 percent of rot and bark. Moisture content is usually limited to a maximum of 50 to 60 percent, because at a higher moisture content, it is too costly to dry the sawdust. In general, no char or sanderdust is allowed, and Douglas-fir or hemlock sawdust is preferred.

Board mills prefer shavings to sawdust because shavings are generally cleaner and fibers are longer. However, no oversized shavings are allowed. Most mills want clean and green shavings with a moisture content that is not too high. Green shavings are usually preferred because they yield a stronger fiber. Some board mills, however, prefer dry shavings with a maximum of 18-percent moisture content. The specification of wet or dry material usually depends on the type of board produced; particle board mills, looking for more fiber strength than either hardboard or insulation board mills, prefer green material. Douglas-fir shavings are the most in demand.

Although most board mills feel their current specifications are already very lenient, there is a consensus that future specifications will allow more bark. Bark content may reach 10 to 15 percent in some board processes. Bark and rot act as sponges, soaking up too much resin in some board processes. However, technological advances are expected to solve this problem. Board mills also see increased use of plywood trim as a source of raw material. Today's plywood trim waste is full of contaminants, but as specifications are developed for this material, use of plywood trim will become more feasible. Specifications will also change to allow the increased use of fine material.

CONCLUSION — POTENTIAL FOR INCREASED USE OF FIBERWOOD OVER PERIOD 1970-80

This study shows that, based on current capacity expectations, annual fiberwood use will increase by 2.8 million O.D. tons by 1980. Pulpmills and board mills view pollution control regulations and final product competition as the major constraints on capacity expansion. If we assume availability of the necessary wood fiber, actual 1980 fiberwood consumption could be increased above the projected level by the development of economical pollution control technology and by a rising product demand; the first is a distinct possibility, and the latter is already a reality. Whereas the board industry projected substantial growth over the next decade, pollution control costs and a slackened demand for paper products in 1970 gave the pulp industry a conservative growth outlook. Rising final product demand with fixed capacity should cause prices to rise. Rising prices will mean higher rates of return, and at some higher rate, firms will invest in increased capacity, thus causing fiberwood use to increase.

From the expected fiberwood consumption pattern, it is obvious that mills expect to continue into the future as they have in the past, consuming approximately 3 million tons of roundwood logs per year and obtaining the remainder from sawmill and plywood residues. Board mills foresee an increased use of bark, sawdust, and dry materials, as do pulpmills. Pulpmills also see being able to use a wider range of species. However, no increase in the use of roundwood logs or logging residue is foreseen. This material will be used only as it becomes Utility grade and is removed at harvest. Most board mills do not have facilities to handle roundwood, and rot and stain limitations will prevent extensive use of logging residues. Pulpmills feel that there is an ample supply of material of lower quality than is presently being used that is more readily available and usable than logging residues. Consequently, mill residue use should increase over the next decade, and any surplus of this material should be only a local phenomenon.

The question then arises "Is there enough mill residue from existing sources to supply future fiberwood needs?" Comparing mill residue production with 1970 and expected 1980 use of residues yields some insight. The apparent 1970 deficit of mill residue fiberwood in Washington is offset by imports of material from Canada, Idaho, Montana, and Oregon.

	1970		1980
	Used	Produced 1/	Expected use
	(1,000 O.D. tons)		
Washington	4,521	4,025	4,795
Oregon	5,218	9,513	7,137
California	1,893	5,839	2,546
Total	11,632	19,377	14,478

The latest national timber review projects timber harvest to decline by 1980 in each of the three States. Coupled with this is an expectation of rising log exports. Under these assumptions, the amount of logs available for lumber and plywood production within the three States must decline. This implies that the 19 million tons of residue produced in 1970 will decline by 1980, while expected use of residues will increase.

Increased utilization of lower quality material, use of a wide range of species, and increased geographical movement of material will allow existing mill residue to supply fiberwood needs for a limited time. It seems highly probable, however, that pulp and board plants will soon have to turn to alternative sources, such as thinnings and logging residues, and perhaps start bidding more competitively among themselves and with sawmill and plywood mills for existing log supplies.

1/ Calculated on the basis of:

a) 81 cubic feet of residue produced per 1,000 board feet of lumber produced.

b) 21.9 cubic feet of residue produced per 1,000 square feet of plywood produced (3/8-inch basis). Assumes cores are sawn for lumber and sanderdust, dry trim, and layup loss not used for fiberwood.

c) 74 cubic feet of residue equals 1 O.D. ton. See Gedney and Henley (6).

LITERATURE CITED

1. Austin, John W.
   1969. Timber flows and utilization patterns in the Douglas-fir region, 1966. USDA For. Serv. Res. Pap. PNW-89, 89 p., illus. Pac. Northwest For. & Range Exp. Stn., Portland, Oreg.

2. Barrette, Brian R., Donald R. Gedney, and Daniel D. Oswald
   1970. California timber industries, 1968: Mill characteristics and wood supply. A joint study by Calif. Div. For. and USDA For. Serv. Pac. Northwest For. & Range Exp. Stn. 117 p., illus.

3. Bergvall, John A., and Donald R. Gedney
   1970. Washington mill study: Wood consumption and mill characteristics, 1968. A joint study by State of Wash. Dep. Nat. Resour. and USDA For. Serv. Pac. Northwest For. & Range Exp. Stn. 119 p., illus.

4. Choate, Grover A.
   1972. Flows of mill residues to pulp and board manufacturers, Washington, Oregon, and California, 1968. USDA For. Serv. Resour. Bull. PNW-39, 49 p., illus. Pac. Northwest For. & Range Exp. Stn., Portland, Oreg.

5. Coughlin, Robert L.
   1972. Relationship of effluent limitations to future pulpmill closures. Environ. Pollut. Agency Work Pap. 88, 93 p., Seattle, Wash.

6. Gedney, Donald R., and John W. Henley
   1971. Utilization estimates for western softwoods--trees, logs, and residue. USDA For. Serv. Res. Note PNW-158, 8 p., illus. Pac. Northwest For. & Range Exp. Stn., Portland, Oreg.

7. Manock, Eugene R., Grover A. Choate, and Donald R. Gedney
   1970. Oregon timber industries: Wood consumption and mill characteristics, 1968. A joint study by State of Oreg. Dep. For. and USDA For. Serv. Pac. Northwest For. & Range Exp. Stn., 122 p., illus.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1973—798-244/55 REGION 10

The mission of the PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, and related environments.

Within this overall mission, the Station conducts and stimulates research to facilitate and to accelerate progress toward the following goals:

1. Providing safe and efficient technology for inventory, protection, and use of resources.
2. Development and evaluation of alternative methods and levels of resource management.
3. Achievement of optimum sustained resource productivity consistent with maintaining a high quality forest environment.

The area of research encompasses Oregon, Washington, Alaska, and, in some cases, California, Hawaii, the Western States, and the Nation. Results of the research will be made available promptly. Project headquarters are at:

Fairbanks, Alaska
Juneau, Alaska
Bend, Oregon
Corvallis, Oregon
La Grande, Oregon
Portland, Oregon
Olympia, Washington
Seattle, Washington
Wenatchee, Washington

Mailing address: Pacific Northwest Forest and Range Experiment Station
P.O. Box 3141
Portland, Oregon 97208

The FOREST SERVICE of the U. S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.


U.S. DEPARTMENT OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY